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*Andrew Gurney*

Dated

14 June 2004

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# Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form.)

Cardiff Road  
Newport  
Gwent NP9 1RH

Fee: £0

1. Your reference 46131.GB01

2. Patent application number  
(The Patent Office will fill in this part) 0312477.3

3. Full name, address and postcode of the or of each applicant (underline all surnames)  
Mars, Incorporated  
6885 Elm Street  
McLean  
Virginia 22101-3883  
United States of America

Patents ADP number (if you know it) 8626544001

If the applicant is a corporate body, give the country/state of incorporation  
Virginia, United States of America

4. Title of the invention  
PROCESS FOR THE PRODUCTION OF  
CONFECTIONERY PRODUCTS

5. Full name, address and postcode in the United Kingdom to which all correspondence relating to this form and translation should be sent  
Reddie & Grose  
16 Theobalds Road  
LONDON  
WC1X 8PL

Patents ADP number (if you know it) 91001 ✓

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number	Country	Priority application (If you know it)	Date of filing (day/month/year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application	Date of filing (day/month/year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

a) any applicant named in part 3 is not an inventor, or  
b) there is an inventor who is not named as an applicant, or  
c) any named applicant is a corporate body.  
See note (d))

YES

**Patents Form 1/77**

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document.

Continuation sheets of this form

Description	6	JMC
Claim(s)	2	
Abstract	0	
Drawing(s)	0	

10. If you are also filing any of the following, state how many against each item.

Priority documents	0
Translations of priority documents	0
Statement of inventorship and right to grant of a patent ( <i>Patents Form 7/77</i> )	0
Request for preliminary examination and search ( <i>Patents Form 9/77</i> )	0
Request for substantive examination ( <i>Patents Form 10/77</i> )	0
Any other documents ( <i>please specify</i> )	0

11. I/We request the grant of a patent on the basis of this application.

Signature

Date

Reddie & Grase 30<sup>th</sup> May 2003

12. Name and daytime telephone number of person to contact in the United Kingdom

N S MARLOW  
020-7242 0901

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PROCESS FOR THE PRODUCTION OF CONFECTIONERY PRODUCTS

5 The invention relates to a process for the continuous production of confectionery products comprising crystallised xylitol.

10 A number of sugar alcohols or polyols, such as xylitol and erythritol, are known to deliver a cooling effect in the mouth when consumed due to their large negative heats of solution.

15 Crystalline hard candies comprising xylitol are known. In order to prepare such candies a molten mass comprising xylitol, either alone or in high proportion in combination with other polyols, is mechanically agitated or seeded with xylitol crystals to cause crystallisation. The resultant seeded mass is then poured into moulds to produce hard  
20 candy.

25 Once the seed crystals have been added, the viscosity of the seeded molten mass is very difficult to control. The seeded mass thickens and crystallises rapidly if the temperature falls below the melting point of xylitol, but thins due to melting of the seed crystals if the temperature drifts above the melting point. As a result, the viscosity of the seeded mass tends to vary upon storage which is particularly undesirable on deposited hard candy manufacturing lines  
30 where any inconsistency in the viscosity of the seeded mass leads to inconsistent piece weight.

35 The difficulty associated with the handling of seeded molten xylitol has until now prevented the satisfactory continuous production of crystallised xylitol based confectionery products.

EP-A-0 528 604 discloses a continuous process for forming melt cocrystallized sorbitol/xylitol in which a homogenous molten blend of sorbitol and xylitol is cooled under agitation until a viscous mass is formed. The viscous mass  
5 is then removed from the agitation means and cooled slowly until the sorbitol/xylitol blend becomes fully crystalline. In this process, crystallisation of the xylitol is achieved by cooling and agitation. For crystallisation to occur, the internal temperature of the agitation means must be lower  
10 than the melting point of the sorbitol/xylitol blends, resulting in a steady build-up of crystallised material on the surfaces of the agitation means. During continuous processing, the steady build-up of crystalline material on the inner surfaces of the agitation means will reduce the  
15 internal volume of the agitation means and hence residence time of the sorbitol/xylitol blend at a fixed throughput rate. Such changes during continuous processing may lead to undesirable variations in the cocrystallized sorbitol/xylitol products produced.

20

GB 1 583 573 discloses a batch process for making xylitol-containing hard caramels in which 10 to 30% by weight of powdered xylitol is added to a xylitol melt, while stirring, at a temperature not substantially exceeding the melting  
25 point of xylitol. The resulting mass is then poured into moulds and left to solidify. For the reasons discussed above, it is difficult to maintain large batches of seeded molten xylitol at a steady viscosity. Hence, during processing of a large batch by this prior art process the  
30 properties of the seeded molten mass will change. While it is possible to work this process on a small scale, the process is difficult to work on a large scale.

According to the present invention there is provided a  
35 process for the continuous production of confectionery products comprising crystallised xylitol comprising: feeding

xylitol in liquid form which is capable of crystallisation on cooling into a mixer together with xylitol seed crystals; mixing the xylitol in liquid form and the xylitol seed crystals to produce a seeded mass; and discharging the  
5 seeded mass from the mixer, wherein the mixer is maintained at a temperature of between 90°C and 120°C, whereby build up of crystallised xylitol within the mixer is substantially prevented.

10 Preferably, the mixer is maintained at a temperature of between about 93°C and about 100°C, more preferably at a temperature of between about 95°C and about 97°C.

The xylitol in liquid form may be molten xylitol or a  
15 solution of xylitol and may comprise xylitol alone or in high proportion in combination with other polyols. Preferably, the xylitol in liquid form is a low moisture xylitol syrup

20 Throughout the specification, low moisture xylitol syrup is used to mean a xylitol syrup having a moisture content of 10% by weight or less. Preferably, the low moisture xylitol syrup has a moisture content of 5% by weight or less, more preferably the low moisture xylitol syrup has a moisture  
25 content of 1% by weight or less.

Preferably, the low moisture xylitol syrup is fed into the mixer at a temperature of between about 170°C and about 210°C, more preferably at a temperature of between about  
30 200°C and about 205°C.

In the mixer, heat is removed from the low moisture xylitol syrup through melting of a substantial amount of the powdered xylitol added as seed. Preferably, the ratio by  
35 weight of low moisture xylitol syrup to xylitol seed

crystals fed into the mixer is between about 30:70 and about 60:40, more preferably between about 40:60 and about 50:50.

5 Preferably, where the process comprises feeding molten xylitol into a mixer together with xylitol seed crystals, the molten xylitol and xylitol seed crystals are fed into the mixer in a ratio of about 75% to about 25% by weight.

10 Preferably, the mixer is equipped with a planetary agitator.

( It will be appreciated that the precise ratio of low moisture xylitol syrup or molten xylitol to seed crystals employed will depend upon, amongst other things, the temperature of the low moisture xylitol syrup or molten  
15 xylitol fed into the mixer, the temperature at which the mixer is maintained and the residence time of the seeded mass in the mixer.

The viscosity of the seeded mass in the mixer can be readily  
20 controlled through variation of the feed rates of the molten xylitol or low moisture xylitol syrup and/or xylitol seed crystals.

( Additives commonly used in the manufacture of confectionery products, such as colours, flavours and acids, may be added  
25 to seeded mass during mixing.

The invention will now be further described, by way of example.

30

Example 1

Powdered xylitol was dissolved in water to form an 80% xylitol solution (by weight solids) at 80°C. The solution  
35 was evaporated in a scraped surface heat exchanger to produce a xylitol syrup containing 2% moisture. The

resulting cooked syrup was fed at a temperature of 195°C and a feed rate of 0.38 kg/min. into a 30 litre oil jacketed in-line mixer equipped with a planetary agitator with vessel walls maintained at 95°C while stirring. Xylitol powder (90  
5 µm grade, Xylisorb® 90 from Roquette) at ambient temperature was also fed into the mixer at a feed rate of 0.56 kg/min. After 12 minutes, with approximately 10kg of seeded mass held in the mixer, an adjustable outlet at the base of the mixer was opened and the seeded mass discharged from the  
10 mixer at a rate of 0.84 kg/min. into a hard candy depositing line hopper through an oil jacketed feed pipe. The exit tap was heated with trace electrical heating tape to a temperature of 95°C to 100°C and the feed pipe was maintained at a temperature of approximately 95°C.

15

#### Example 2

Powdered xylitol was melted in a screw feeder at 150°C. The resulting molten xylitol was fed at a temperature of 96°C to  
20 100°C and a feed rate of 0.6 kg/min. into a 30 litre oil jacketed in-line mixer equipped with a planetary agitator with vessel walls maintained at 95°C while stirring. Xylitol powder (90 µm grade), Xylisorb® 90 from Roquette) at ambient temperature was also fed into the mixer at a feed rate of  
25 0.24 kg/min. After 12 minutes, with approximately 10kg of seeded mass held in the mixer, an adjustable outlet at the base of the mixer was opened and the seeded mass discharged from the mixer at a rate of 0.84 kg/min. into a hard candy depositing line hopper through an oil jacketed feed pipe.  
30 The exit tap was heated with trace electrical heating tape to a temperature of 95°C to 100°C and the feed pipe was maintained at a temperature of approximately 95°C.

In examples 1 and 2 the sum of the feed rates of the xylitol  
35 in liquid form and the xylitol seed crystals into the mixer is equal to the rate at which the seeded mass is discharged



from the mixer thereby ensuring that the mass is maintained at a steady level in the mixer during continuous processing.

5 In examples 1 and 2 the temperature of the mixer is maintained at or just above the melting point of xylitol; the melting point of xylitol is about 94°C. Crystallisation of the seeded mass on the internal surfaces of the mixer is thereby substantially prevented. The temperature at which the mixer is maintained and the residence time of the seeded  
10 mass in the mixer in the examples are such that no significant melting out of the added seed crystals occurs. It will be appreciated that if the xylitol in liquid form comprises, for example, other polyols, the temperature at which the mixer is maintained may be reduced provided that  
15 it is still such that crystallisation of the seeded mass on the internal surfaces of the mixer is substantially prevented.

20 It will be appreciated that while in the examples given above the mixing vessel is an in-line mixer equipped with a planetary agitator, other mixing vessels could be employed, such as screw action mixers, mixer extruders, jacketed dough beaters or jacketed fondant beaters.

25 It will also be appreciated that while in example 2 above the powdered xylitol is melted in a screw feeder, other means suitable for the continuous production of molten xylitol could be employed.

**CLAIMS**

1. A process for the continuous production of confectionery products comprising crystallised xylitol  
5 comprising:  
    feeding xylitol in liquid form which is capable of crystallisation on cooling into a mixer together with xylitol seed crystals;  
    mixing the xylitol in liquid form and the xylitol seed  
10 crystals to produce a seeded mass; and  
    discharging the seeded mass from the mixer,  
    wherein the mixer is maintained at a temperature of between 90°C and 120°C, whereby build up of crystallised xylitol within the mixer is substantially prevented.  
15
2. A process according to claim 1 wherein the mixer is maintained at a temperature of between 93°C and 100°C.
3. A process according to claim 1 or 2 wherein the mixer  
20 is maintained at a temperature of between 95°C and 97°C.
4. A process according to any of claims 1 to 3 wherein the xylitol in a liquid form is molten xylitol or a low moisture xylitol syrup.  
25
5. A process according to claim 4 wherein the ratio by weight of low moisture xylitol syrup to xylitol seed crystals fed into the mixer is between 30:70 and 60:40.
- 30 6. A process according to claim 4 or 5 wherein the ratio by weight of low moisture xylitol syrup to xylitol seed crystals fed into the mixer is between 40:60 and 50:50.
7. A process according to claim 4, 5 or 6 wherein the low  
35 moisture xylitol syrup has a moisture content of 5% or less by weight.

8. A process according to any of claims 4 to 7 wherein the low moisture xylitol syrup has a moisture content of 1% or less by weight.
- 5 9. A process according to any of claims 4 to 8 wherein the low moisture xylitol syrup is fed into the mixer at a temperature of between 170°C and 210°C.
- 10 10. A process according to any of claims 4 to 9 wherein the low moisture xylitol syrup is fed into the mixer at a temperature of between 200°C and 205°C.
- 15 11. A process according to claim 4 wherein the molten xylitol and xylitol seed crystals are fed into the mixer in a ratio of about 75% to about 25% by weight.
12. A process according to any preceding claim wherein the mixer is equipped with a planetary agitator.
- 20 13. A process for the continuous production of confectionery products comprising crystallised xylitol substantially as described.